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Government of the North-Eastern State of Nigeria
Ministry of Natural Resources

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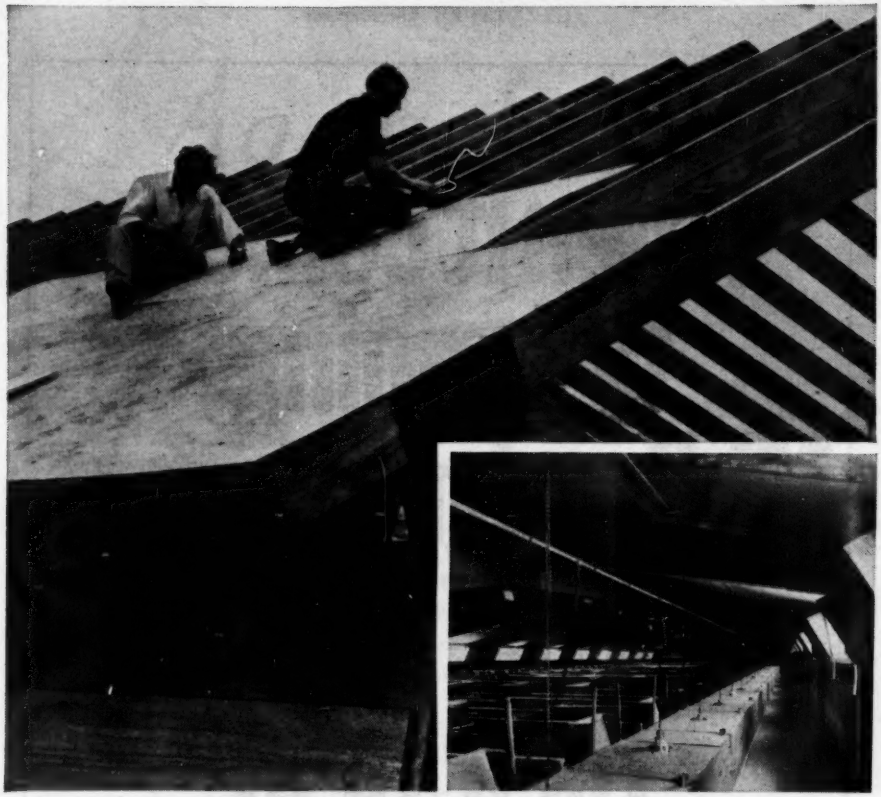

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AGRICULTURE NOVEMBER 1970

The Changing Structure of British Agriculture

C. J. Brown

THE statistical records of the Agricultural Departments now cover a period of over a hundred years, an occasion marked in 1968 by the publication of *A Century of Agricultural Statistics: Great Britain 1866–1966**. Two world wars and the years immediately following saw the introduction of new time-series and improvements to meet new needs. The 'sixties mark yet another phase, which is especially important from the standpoint of structural change within the industry and the associated trend towards greater concentration in a number of enterprises. Fortunately, the introduction of powerful computers to process the agricultural census returns has enabled these developments to be analysed in considerable detail and in more sophisticated ways than would otherwise have been possible. Many of the results have recently been published† and the purpose of this article is to provide a brief account of the major changes for those readers who lack either the time or inclination to delve into the statistics for themselves. The opportunity is also taken to include some later information which has become available for England and Wales. The report itself relates to the whole of the United Kingdom but, because of significant differences in farming characteristics, the individual countries are for the most part dealt with separately.

The maxim 'Plus ça change, plus c'est la même chose' will no doubt always have some relevance to British agriculture, and this must certainly be true when one looks at developments over a period of no more than ten years. Very few farming activities can be classified as short-term; by their very nature most are medium- to long-term ventures largely conditioned by location—soil, climate and local tradition—and by the kind and extent of capital investment. So the broad pattern of major enterprises will be seen, with modifications, to have persisted. The data given below on type-of-farming classification, nevertheless, provide evidence of some important changes of emphasis. Another persistent general feature, despite a decreasing total number of farming units, is the continuing high proportion of part-time and mainly part-time holdings whose aggregate contribution to agricultural output remains very small. Against such a relatively stable background, any significant trends towards greater concentration and specialization appear in more dynamic contrast.

**A Century of Agricultural Statistics: Great Britain 1866–1966.* H.M.S.O., 1968. 17*s.* 6*d.*
†*The Changing Structure of Agriculture.* H.M.S.O., 1970. 6*s.* 6*d.*

Size of farms

In 1960 there were in the United Kingdom some 440,000 agricultural holdings which could be classified as significant farming units. The number had fallen to about 380,000 by 1968, in which year a further 34,000 were excluded from the England and Wales census on the ground that their contribution to agricultural output was negligible. The total number of statistically significant holdings at the end of the decade may be taken as approximately 340,000, comprising a total area of just over 30 million acres of crops and grass; this is still within one per cent or so of the corresponding area in 1960. The average size of holdings making agricultural returns has consequently increased from 70 to nearly 90 acres of crops and grass per holding (in England and Wales from 74 to 97 acres). There continue to be proportionately far fewer large farms in Wales and Northern Ireland than in England and Scotland. Despite a general trend towards increasing farm size in each country, the predominance of small farms remains a distinctive feature of Northern Ireland. Incidentally, the average size of agricultural holdings in the European Economic Community countries is less than half the average for Britain.

A more meaningful measure of farm size which is now regularly employed is based on the standard labour requirements for the cropping and stocking of individual holdings, expressed as standard man-days (smds) per acre of crops or per head of livestock*. Periodical revisions to these smd factors have to be made as the result of technological changes, and this necessarily affects temporal comparisons. Nevertheless, it can be said that the proportion of very small holdings (with under 275 smds), roughly one-half, and their contribution to total output, roughly one-thirteenth, are still much the same as in the early 'sixties. Such holdings numbered about 165,000 in the United Kingdom in 1969, compared with 84,000 small holdings, 57,000 medium-sized holdings and approximately 34,000 large holdings (1,200 smds and over). These large holdings, so defined, numbered 10 per cent of the total but contributed virtually one-half of the national output. In England and Wales one per cent of all holdings, those capable of providing full-time work for at least fifteen men (4,200 smds or over), now account for nearly a sixth of the total output. In recent years special investigations have been made into the number of 'full-time' farms, taking into account smd criteria, multiple occupancies and the time actually spent by occupiers on their holdings. The results indicate an average rate of decline of about 4,000 a year since 1963, or about 6,000 a year if smd revisions due to technological change are included. In 1969 there were estimated to be about 190,000 full-time farms in the United Kingdom, of which 146,000 were in England and Wales. Among these there appear to have been upwards of 13,000 small farms on which the occupiers were engaged full time in tending fewer crops and livestock than would normally be expected to provide full-time employment for one man; there could be varied reasons for such a situation, e.g., age, ill-health or lack of capital.

Types of farming

A similar system of classification by farm type, based on standard labour requirements, is employed in England and Wales and Scotland. In Northern

*The annual requirements of manual labour needed *on average* for the production of crops and livestock with essential maintenance, etc. tasks. Further information is given in official publications on farm classification.

Ireland a different criterion has been adopted, namely, the relative contribution of each enterprise to the total gross margin of the farm business. There are also differences of nomenclature between the countries. In England and Wales six major types of farming are distinguished as full-time holdings (275 smds or more), subdivided into thirteen classes listed in Table 1 which shows the changes in numbers that have occurred since 1963.

Table 1. Types of full-time holdings in 1963 and 1969 (England and Wales)

	Type of Farming	*1963*		*1969*		Thousands* *Change*	
	Dairy:						
1.	Specialist dairy	29·7	64·6	30·6	52·0	+ 0·9	−12·6
2.	Mainly dairy	34·9		21·4		−13·5	
	Livestock rearing and fattening:						
3.	Mostly cattle	2·9	23·5	5·5	21·6	+ 2·7	− 1·9
4.	Mostly sheep	6·5		3·4		− 3·2	
5.	Cattle and sheep	14·2		12·7		− 1·5	
	Pigs and poultry:						
6.	Predominantly poultry	4·2	8·7	3·3	9·0	− 0·9	+ 0·3
7.	Pigs and poultry	4·5		5·7		+ 1·2	
	Cropping:						
8.	Mostly cereals	6·3	24·8†	9·4	24·1	+ 3·1	− 0·7
9.	General cropping	18·5		14·8		− 3·8	
	Horticulture:						
10.	Predominantly vegetables	2·0	15·9	1·7	13·0	− 0·2	− 2·9
11.	Predominantly fruit	2·8		1·9		− 0·8	
12.	General horticulture	11·2		9·3		− 1·9	
13.	**Mixed**		22·7		13·4		− 9·3
	All Full-time holdings (275 smds or more)		160·2		133·0		−27·2

*All figures have been rounded to the first decimal place, i.e., nearest 100, so that totals and sub-totals do not necessarily agree exactly with the sums of constituent parts

†Subdivision estimated from 1964 data after revised definition

Although the above changes have been affected to some extent by necessary revisions to smd factors in 1966 and 1968, the decline in mixed farming is clearly significant. A reduction in the number of dairy farmers has been accompanied by some strengthening of the specialist class. In livestock rearing and fattening, cattle have taken precedence over sheep, whilst in cropping there has been a notable shift from general crops to cereals. The fact that there are now fewer predominantly poultry holdings reflects the trend towards high concentration in this enterprise; in 1963 this class accounted for roughly a third of all laying fowls, by 1969 almost one-half. At the earlier date breeding pigs were widely distributed among several farming classes, whereas in 1969 the proportions had contracted to only 9 per cent on mainly dairy holdings (15 per cent in 1963), to 10 per cent on general cropping holdings (formerly 15 per cent) and to 17½ per cent on mixed holdings (from 20 per cent). By contrast, the proportion of breeding sows and gilts in the pigs and poultry class has more than doubled (from 14 to 31 per cent). The tendency towards greater specialization, found in all three countries, is further illustrated by the following smaller contributions of the mixed

farming class to various kinds of enterprise in England and Wales in 1969 (estimates for 1963 in brackets): dairy cows 11 per cent (14); beef cows 9 per cent (15); breeding sheep 11 per cent (16); barley acreage 15 per cent (20). Significant as such variations of pattern undoubtedly are, the dimensions of the general enterprise structure remain comparatively stable. Evidence of this is furnished by the most recent smd analysis for England and Wales when compared with the position in 1964; comparable data for 1963 are not available. As might be expected, the most stable proportions shown in Table 2 are those for the longest-term farming activities, dairying and livestock rearing (other than pigs and poultry).

Table 2. Distribution of standard man-day requirements in 1964 and 1969
(England and Wales)

Type of Farming	*Percentage of Total Smds* 1964	1969
Dairy	27·9	27·7
Livestock rearing and fattening	9·7	10·2
Pigs and poultry	6·4	7·8
Cropping	19·4	21·4
Horticulture	15·6	14·6
Mixed	13·1	10·9
All full-time holdings	92·1	92·6
Part-time holdings	7·9	7·4
Total	100·0	100·0

Concentration of enterprises

Trends towards concentration are most readily seen by comparing the average size of enterprise at different dates and the proportion of livestock or crop acreage found in the larger units. Such statistics provide some striking examples of the rate at which rationalization has been proceeding in various sectors of the agricultural industry. The most dramatic instances are found in the production of eggs, poultry meat and pigmeat, but important changes have also taken place in other major enterprises. Comparative rates of growth for England and Wales are shown in Table 3; similar gains, varying in degree, have occurred in Scotland and in Northern Ireland.

Table 3. Average annual increase in size of enterprise 1960-1969 (England and Wales)
(per cent per annum compound)

Enterprise	*1960–65*	*1965–69*	*1960–69*
Dairy cows	4·5	6·8	5·5
Beef cows	2·5	5·7	3·9
Breeding ewes	2·7	3·6	3·1
Breeding pigs	8·4	9·9	9·1
Laying fowls*	10·3	12·4	11·2
Broilers	32·5	13·2	23·6
Wheat	7·6	5·1	6·5
Barley	5·4	7·7	6·4
Potatoes (main crop)	5·3	6·0	5·6

*In 1960, fowls six months old and over; in 1965 and 1969, fowls laying eggs for eating.

It will be seen that, in general, the above rates of increase have accelerated since 1965. Broilers are an important exception; the number of birds doubled between 1960 and 1965 whilst the number of broiler holdings was halved, so that the average size of holding actually quadrupled—an effective increase of 32·5 per cent per annum. Between 1965 and 1969 a further, less drastic, shake-out of holdings occurred with continued concentration into large industrialized units. There are now rather more than 2,000 units with an average size of over 15,000 birds, compared with some 5,700 holdings with an average of 2,300 birds in 1960. The largest broiler enterprises, with 100,000 or more birds, have increased their share from just over 10 per cent to nearly 40 per cent. The next smaller size group, those with between 50 and 100 thousand birds, have also more than trebled their share, to 20 per cent.

In the case of laying fowls (producing eggs for consumption), the total bird population has not greatly changed since the mid-sixties, but the number of producers has declined by about one third; the consequential increase in average size of flock has been roughly one half. By 1969 about 1,700 holdings (1·7 per cent), with flocks of at least 5,000 fowls, accounted for 56 per cent of the laying birds in England and Wales, and of these 660 (0·6 per cent), those with more than 10,000 fowls, contributed almost 40 per cent. Only five years earlier the latter size group had been half as numerous and its contribution a third as large.

After poultry, the greatest relative growth in average size of enterprise is to be found in pig breeding, where the average herd has been increasing by 10 per cent per annum in recent years. Since 1960 over 30,000 small-scale breeders have moved out of pig production in England and Wales and 8,000 in Northern Ireland. Commercial breeders in this country with 100 or more breeding sows and gilts have more than trebled their share (to 20 per cent) of the national total since 1960, whilst those with 50–99 breeding pigs have more than doubled theirs (to 21 per cent). Yet these two size groups together comprised no more than 3,200 holdings (6·6 per cent) out of a total of 48,400 with breeding pigs at the June 1969 census.

Comparative statistics for other livestock and cropping enterprises, though less striking than those singled out for comment above are, nonetheless, strongly indicative of a general trend towards concentration, which appears to have gained some momentum in the late 'sixties. Thus, apart from breeding sheep, Table 3 shows a recent rate of growth in the average size of other major enterprises varying between 5 and 8 per cent per annum. One should, however, bear in mind that this tendency owes much to increasing contributions from medium-sized as well as from large farms, and also latterly to the Government's policy of encouraging the amalgamation of small farms. Finally, it is reassuring to reflect that much progress has already been achieved in the restructuring of British agriculture at a point in time when the European Economic Community is drafting legislation for the radical reform and modernization of farming in its member countries—as envisaged in the modified Mansholt Plan 'Agriculture 1980'.

This article has been contributed by **C. J. Brown, M.A.,** formerly Chief Statistician of the Ministry of Agriculture, Fisheries and Food.

Club Root of Brassica Crops

G. R. Dixon J. K. Doodson

CLUB root is one of the most widespread and devastating diseases of brassica crops. Records of the disease may be traced back to the fifteenth century in Spain and to 1736 in England.

Symptoms and cause

Club root is easily recognized by the presence of tumorous galls on the roots and hypocotyls of brassica plants. Stunting of the plants accompanied by wilting and yellowing of the foliage are also typical symptoms of this disease.

The type of club root gall formation can vary considerably depending upon the crop and the soil type on which it is grown. Swedes infected with club root in Lancashire moss peat exhibit typical finger and toe symptoms, i.e., the fibrous roots have large cylindrical galls extending down into the peat whereas the root 'bulb' is far less heavily galled. On loamy soils in Herefordshire and Cardiganshire, however, symptoms tend to be confined to the 'bulb' with less galls on the fibrous roots. Crops such as the cabbages and rapes when infected develop a coralloid system of nodules extending over the whole root system. In the 'bulbous' rooted crops, swedes and turnips, infection is more localized with only a few large galls formed.

The disease is caused by the soil borne fungus *Plasmodiophora brassicae*; the fungus and disease were first linked in 1878 by the Russian worker M. S. Woronin. *P. brassicae* is found in soil as minute resting spores. From these swarm cells develop which invade the host root hairs and there pass through a reproductive phase. The fungus then invades deeper into the root cortex and forms complex structures containing numerous infective spores. These are liberated into the soil when the host root decays and can infect plants grown in succeeding years.

The resistance or susceptibility of a standard set of brassica varieties varied when they were inoculated with isolates of *P. brassicae* from different areas. This indicates that the fungus can be classified into a series of physiologic races. These races have been demonstrated in Europe, the United States and New Zealand. Variation in the resistance of brassica varieties to club root in different parts of Britain could be attributed to the distribution of physiologic races, but their frequency and relative importance is yet to be determined.

Varietal reaction and effect on yield

Previous studies at the National Institute of Agricultural Botany, Cambridge, have shown that resistance to club root is present in a number of swede, turnip and rape varieties. Because of the increased development of resistant varieties further field trials have been carried out. The reaction of varieties to infection has been studied by means of replicated trials over a period of fifteen years using areas of land known to be infected with the pathogen.

Disease symptoms were assessed using a 1–5 scoring system as shown below:

Table 1

Scoring system used to assess club root

Category	*Score*
Roots healthy	1
Discrete individual galls on the 'bulb' or fibrous roots	2
Galls clumped together but covering less than 50% of the 'bulb' or fibrous roots	3
Galls clumped together and covering more than 50% of the 'bulb' or fibrous roots	4
Roots rotten*	5

*Ultimately club root may cause the roots to rot but this effect is complicated by the entry of bacteria. Scores 4 and 5 were, therefore, added together when calculating the disease rating because differences between these categories may not always be due to the effect of club root.

From the results obtained using this key a disease rating for each variety was calculated by applying the formula:

$$\frac{\text{Score } 2 \times 2 + \text{Score } 3 \times 3 + (\text{Score } 4 + \text{Score } 5)\,5}{\text{Total No. of roots} \times 5} \times 100$$

Use of this genometric rating gave a single figure which expressed disease severity in terms of number of roots infected per variety and the intensity of symptom development on those roots thus differentiating between susceptible and the more resistant varieties; a disease rating of 100 would indicate all plants were severely infected. The disease ratings obtained from a range of varieties grown at two trial sites (Rosemaund and Trawscoed E.H.F.s) and the yield obtained at one site are given in Table 2.

At Trawscoed the resistant swedes, Chignecto, Wilhelmsburger and Wye showed only slight infection when compared with the susceptible control variety Acme. The level of disease was greater at Rosemaund but the resistant varieties yielded well when compared with the control. The resistant turnips, Debra, Gelria A and Gelria R were lightly galled at Rosemaund and Traws-

coed while the susceptible control, Green Globe was heavily infected. The resistant rape Nevin, was only slightly galled at Trawscoed but showed extensive galling at Rosemaund. At the latter site, however, Nevin was less stunted than the control, Early Giant, and gave twice the yield. Nevin thus appeared to have a capacity to tolerate infection and still give a useful yield. Differences in the amount of gall development on Nevin at Rosemaund and Trawscoed possibly indicated the presence of different physiological races of *P. brassicae* at these two centres.

Table 2

Disease ratings and yield figures for swede, turnip and rape varieties, 1969

	Disease rating		†Yield tons/acre fresh weight
	Trawscoed E.H.F.	*Rosemaund E.H.F.*	*Rosemaund E.H.F.*
Swede			
Chignecto	5*	28*	25·2*
Wilhelmsburger	8*	58*	13·3*
Wye	10*	46*	19·0*
Acme (C)	100	98	2·0
Turnip			
Debra	0·4*	4*	26·7*
Gelria A	0·5*	2*	24·8*
Gelria R	2*	4*	25·0*
Green Globe (C)	85	98	1·3
Rape			
Nevin	22*	100	4·9
Early Giant (C)	98	100	2·4

C = control.
* = significantly different from control P = 0·05.
† = yield of swedes and turnips measured by root weight, and rape measured by leaf and stem weight.

Methods of control

Resistant varieties. The most effective way of controlling club root is by resistant varieties, where these are available. The N.I.A.B. Recommended List of swede stocks gives agronomic information and details of varietal reaction to club root. Swede varieties currently listed as possessing resistance to club root are: Chignecto, Wye, Danila, Resfingtoe, Wilhemsburger (Øtofte), Wilhelmsburger (Cullen) and Wilhelmsburger (Gartons). Details of club root resistance in varieties of other crops are contained in the N.I.A.B. Leaflet 'Green Fodder Crops*.

Cultural. In the past, club root was held to be a disease that occurred mainly on acid soil, consequently liming was advocated as a control. It is now apparent that *P. brassicae* can exist in soil of alkaline reaction and that other factors such as soil moisture and temperature will also influence disease development. Probably in alkaline soils infection will only occur within critical limits of soil moisture and temperature, whereas successful infection can occur in acid soils despite wide fluctuations of these factors.

Soil aeration by deep cultivation combined with a long rotation keeping brassica crops away from infected soil for as long as possible will reduce the

*Obtainable from the Librarian, N.I.A.B., Huntingdon Road, Cambridge. Price 9*d.* and stamped addressed envelope.

concentration of fungus in a soil. But the fungus is extremely long lived and periods of ten years without a brassica crop may be required. At the same time care must be taken to eradicate weed hosts, for the pathogen can exist and reproduce in the roots of cruciferous weeds such as shepherd's purse (*Capsella bursa-pastoris*), charlock (*Sinapis arvensis*) and wild radish (*Raphanius raphanistrum*) and some grasses.

Chemical. Dipping plant roots into a slurry of 4 per cent calomel is helpful in controlling the disease but only practicable with transplanted crops such as cabbages, cauliflowers and Brussels sprouts. For swedes and turnips and other direct drilled crops no chemicals have given satisfactory control.

Recent research indicates that the new systemic fungicides will control club root in cabbage crops and, in the future, it may be possible to protect direct drilled crops, such as swedes and turnips, using these chemicals.

Acknowledgment

The authors wish to thank B. W. Beeney and H. Davies (Regional Trials officers of the N.I.A.B. at Rosemaund and Trawscoed E.H.F.s) and officers of the N.I.A.B. Root and Fodder Section for their valuable assistance.

This article has been contributed by **J. K. Doodson, B.Sc., Ph.D.**, and **G. R. Dixon, B.Sc., Ph.D.**, who are respectively Plant Pathologist and Assistant Plant Pathologist in the Trials Branch of the National Institute of Agricultural Botany, Cambridge.

★ ★ ★ ★

PIGS BY PROXY

Our cover picture this month shows the three piglets and the sow to whom they were born earlier this year at the Ministry's Central Veterinary Laboratory as a result of the successful transfer of fertilized pig eggs from one continent to another. The genetic parents of the piglets were in a minimal disease herd of the Canadian Department of Agriculture at Hull, Quebec. The piglets were strong and healthy and well above average weight at birth.

An account of a short visit made by F. W. Shepherd, the Ministry's Senior Horticultural Adviser, to study

Horticulture in Rumania

A FORTNIGHT in the middle of February is not the best time to study horticulture on the continent of Europe, particularly when the visit coincides with a couple of fairly heavy falls of snow. Rumanian horticulture, however, is an important and flourishing industry and with the excellent facilities provided by the British Council and the Rumanian Government I was able to see much that was interesting and impressive during my tour.

The Rumanians say they have three main reasons for giving horticulture an important place in the plans for developing their country. The first is import saving. The industry can provide highly nutritious foods rich in vitamins which add variety to the diet at all times of the year without using foreign currency for the import of citrus and other fruits. It also provides a range of alcoholic and other drinks which further reduce imports. Secondly, by exporting horticultural produce much needed currency can be obtained from other countries. Thirdly, to improve the environment. Flowers and plants are grown for the homes of a people moving rapidly from a rural to an urban environment and longing to take some plants with them; and, at the same time, trees, shrubs and other plants to enrich the surroundings of the numerous blocks of flats and the older public buildings which are being preserved with such care.

As might be expected in a Communist State, the industry is organized in all its sectors and an obvious effort is made to provide workers and students with every opportunity to influence planning and development.

I was able to see something of the horticultural education, research and production in the country while I was there. Horticultural education is not normally included in the universities but there are three faculties of horticulture associated with agricultural and veterinary faculties in large agricultural institutes. Between them they are taking in 240 horticultural students each October, and since the failure rate is very low there is almost this number entering the industry as technical assistants, instructors, teachers and research workers each year. The five-year courses are comprehensive in their coverage of theoretical and practical horticulture; but they also include a broad education in political, social and economic sciences as well as the biological and physical sciences, and courses for all in landscape design, the processing industry, a foreign language and physical education. To do all this the students start at 7.30 a.m. each day, six days a week, from October until early-February. This is followed by three weeks of examinations and the second term starts in early March and runs until the end of May. After three more weeks of examinations all the students go to horticultural holdings for practical work from July until September. Practical instruction, which is clearly distinguished from practical work, is undertaken in the open, in greenhouses or in laboratories every afternoon during the

two terms. Those who have failed examinations during the year re-sit during September. Tests are given throughout the terms and all marks obtained are added to those awarded for the examinations. At the end of the first and subsequent years the best students are given certain privileges such as higher grants, choice of places in which to work in the summer and, towards the end of the course, opportunities for foreign travel. At the end of the five years the best students are offered grants for three-year courses leading to a doctorate, and subsequently posts on the teaching or research staffs of the educational or research institutes. The doctorate is not granted at the end of the three years course but four years later, after further research projects have been completed.

Research is under the general guidance of the Academy of Agricultural and Sylvicultural Sciences. This consists of about seventy of the country's leading scientists and production specialists and a small staff, which includes a Director of Production and a Director of Scientific Research. Consultations about research activities are regularly held with the Minister of Agriculture and the Union of Agricultural Co-operatives. Scattered throughout the country there are research stations, each concerned with one of the main groups of crops or livestock, and experimental stations, each of which covers one or more groups. There are about forty such stations and in total they occupy some 70,000 hectares of which 9,000 were, at the time of my visit, said to be devoted to experiments. While some fundamental research is undertaken most is directly applied to crop problems, and the results are carried through from the development to the production stage on experimental stations and state horticultural holdings. An example may be taken in the plant breeding field. There appeared to be considerable plant breeding activity with many horticultural crops. Several strikingly large and highly coloured apples have been produced at Cluj and there is a breeding programme with Malus species in an effort to produce cultivars which will thrive at higher altitudes than those capable of doing so at present. The station has a considerable area of land for testing its seedlings both in the usual climatic surroundings and at higher altitudes. The better seedlings are quickly propagated and distributed to other stations and the best, such as Red of Cluj, can soon be bulked up for distribution to state farms and co-operatives.

With flowers the development routine is similar; for example, a large tetraploid carnation Glory of Cluj is beginning to be quite widely grown in state glasshouses and co-operatives. Crops produced from seeds are developed in the same way and, like the fruit and vegetables, are widely tested against local and foreign cultivars. Those which are an improvement on older types are bulked up and the seed made more widely available until all holdings with suitable conditions have dropped the old in favour of the new.

In disease, pest and weed control, some chemicals are still imported but others are manufactured in the country. All are tested for effectiveness and risk to crop plants and animals, including humans. This is undertaken on stations in all parts of the country but under the control of an institute near Bucharest.

Agriculture and horticulture together occupy just over 60 per cent of the land of the country (forestry occupies another 26 per cent) and employs over 50 per cent of the population of twenty million. Although the land devoted to horticultural crops is only about 5½ per cent, proportionally not

very great, the following figures indicate a not inconsiderable horticultural industry:

	hectares
Orchards and orchard nurseries	419,600
Vineyards and vine nurseries	342,800
Vegetables and melons	234,200
Potatoes	316,200
Medicinal and aromatic plants	10,200
Greenhouses, both glass and plastic covered	2,000
Plastic tunnels	600

Much of the fruit being grown is young and not yet in full bearing. Large areas of orchards and vineyards have been planted on gently sloping hillsides or on terraces on more steeply sloping land. Vegetable growing is being extended and intensified on the more or less level land near the Danube and other rivers where large irrigation schemes are being developed, mainly by British contractors.

There are several large greenhouse units. One north of Bucharest is over fifty hectares in area and is intended to be more than doubled in size within a year or two. The houses are of the Venlo type and built by a Dutch company in blocks of five hectares each. Good crops of carnations and cucumbers were seen. There were also smaller plots of aubergine, capsicum and peppers of various kinds, lettuce and other salads such as caraway, the young leaves of which are used in green salads and soups. The light in winter is better than in Britain and most crops showed this by their better growth, although tomatoes were not so good as might have been expected. This large State glass holding is close to a source of natural gas which is piped direct to the vast boilers used for heating. Considerable heat is necessary in the very cold winters and many crops are grown over buried hot water pipes which are used in addition to the normal above ground piping. The overall management of these holdings is vested in the manager and assistant technical managers who define the general policy, but responsibility for all day-to-day work rests directly with sub-managers or foremen, who are each responsible for the work on a five hectare unit.

Marketing, both internally and for export, is organized by Fructexport, a State company backed by a research unit concerned with packaging, processing and storing fruit and vegetables. Production is planned each autumn for the following season and the State and the large co-operative holdings grade out the very best for export. Most is sent direct from the packing stations by large refrigerated lorries to all parts of Europe, the invoicing and other details are handled by Fructexport. The quality of the small amount of produce I saw being marketed in February was high but the proportion suitable for export was small.

I suppose guests are always given the best but the wine from one of the experimental stations and from a state winery was first class. Apple, black currant and other non-alcoholic fruit juices were equally good.

This quick tour of a quite large area of Rumania impressed upon me the great enthusiasm for horticultural development, which has a large production potential, and the keen desire among Rumanian people for increasing contact with Britain. This stems partly from a desire to export, partly from a seeking after scientific and technical knowledge, and partly to give themselves a chance to learn our important international language and the contact it gives with Western Europe.

Francis R. Frampton, **Chairman of the British Commercial Glasshouse Manufacturers Association, writes about the new***

Minimum Standards for Glasshouse Construction

'Your glazing is new and your plumbing's strange
But otherwise I perceive no change;
And in less than a month, if you do as I bid,
I'd learn you to build me a Pyramid'.

Kipling—*The Two Sided Man.*

THREE major disasters have shaken the reputations of the construction industry and its associated professions. The Tay Bridge collapse in 1879 led to new standards fo. wind loading; the Tacoma suspension bridge collapse in Washington in 1940 led to a thorough investigation of resonance and vibration; more recently Ronan Point has brought up progressive collapse.

At the time of that disastrous gas explosion, structural engineers, research workers and architects had been compiling data for a new code of practice related to the wind loads on all types of buildings. Progress had been slow because of certain disagreements on major issues. Following the disaster, the embryo draft code was circulated to all interested parties.

Although there is almost no evidence of structural failure due to wind, it has been suggested that these new proposals, had they been adopted in their original form, would have added considerably to the total cost of construction in this country; and that the incidence of failure would probably remain virtually unchanged. When the draft was studied and applied to commercial glasshouses it was very difficult to reconcile its recommendations with what had been proved to work in thousands of cases over many years.

The nature of the problem can be illustrated by the example of single span mobile glasshouses not tied to the ground, of which there are many whose weight is below 5 lb per square foot. Putting the worst interpretation on figures in the draft code for most of the south coast, the up-lift could exceed 20 lb per sq. ft. Experience showed this to be about four times too high. Similar results were obtained in relation to the overturning of foundations, struts under valley gutters, strength of glazing bar bolts, glass breakage, strength of trusses and purlins etc. But in practice glasshouses exposed to the

*Short Term Leaflet 106. Minimum Standards for Glasshouse Construction—Loading. Single copies available from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT.

hurricane in Sheffield in 1963 came off better than many conventional buildings, and in the Glasgow hurricane in 1968 a very exposed widespan suffered no damage except to its brickwork.

Had the draft proposals become a requirement for glasshouses it would be necessary to build them much stronger than any in existence today. The light factor would be considerably reduced, the extent of concrete around the stanchion bases would restrict mechanized cultivation, and the increase in capital costs would seriously handicap the competitive position of British growers.

Acceptable standards for glasshouses

Thus the need for the establishment of acceptable standards for glasshouses arose directly out of the potentially unrealistic situation created by the new draft Code of Practice for British Standard Loadings: Wind Loads and the Building Research Station digests 99 and 101. It was difficult to apply these very general codes to the specific problems of glasshouse construction.

Moreover, British manufacturers were required, for grant purposes, to certify that their designs would withstand a snow load of 10 lb per sq. ft and wind loads as set out in British Standard Code of Practice, whereas Dutch glasshouse designs are based on a snow load of approximately 5 lb per sq. ft. Because of such anomalies it was agreed to produce standards related specifically to commercial glasshouses.

That so much has been achieved so quickly is largely due to the periodic discussions on mutual problems between the Ministry, research organizations, representatives of the glasshouse industry, and leading members of the British Commercial Glasshouse Manufacturers Association. The standards have, therefore, been thoroughly discussed during all stages of their development with all interested parties.

As soon as the problem was examined it became apparent that there was an extreme paucity of fundamental data, and an occasional conflict between various relevant national codes. Fortunately there are thousands of glasshouses throughout the country which have stood the test of time and are identical or similar in shape. These were used as a yardstick.

In the absence of reliable theoretical data the task has been to try to establish, and make the code fit, the facts of what works in practice; to strike the right balance between safety, good husbandry and initial cost and to provide the correct common ground from which glasshouses can be freely developed on a fair basis of competitive efficiency.

Snow load

For many years agricultural buildings have used 10 lb per sq. ft as a snow load, but investigation revealed that there are in fact two separate problems. When snow first falls it covers the whole roof but is not normally dense. Later on it starts to melt and slides down the roof into the gutters where it can become very dense.

Thus glasshouses are required to conform to two different conditions of which the worst condition will dictate the design standard. In the first case, where snow is evenly distributed over the whole roof, the snow load for design purposes is 7·3 per sq. ft (350 newtons per square metre). Subsequently, after the snow has slid into the valley, the load is 16·7 lb per sq.

ft (800 N/m²) distributed over the bottom third of the roof slope. In practice this means that the span of glazing bars between the valley gutter and bottom purlin should be reduced from the traditional six or seven feet to little over four feet. Similarly, many valley gutters may need additional support in the form of knee bracing, etc. Conversely the truss and upper purlins can be slightly reduced due to the 27 per cent reduction in initial snow load.

Wind load

The extreme gust wind speed selected for the design of glasshouses is 100 m.p.h. (45 metres per sec.) which applies to most of England. In more exposed areas, including West Cornwall, the west and north coasts of Wales, the extreme coastal strip of Lancashire and most of Scotland, glasshouses should be either permanently sheltered or strengthened.

The pressure actually created by a given wind speed on a building will depend largely on its size and height and the amount of natural shelter created by local geographical features. These and other factors are taken to establish, for use in design, a basic dynamic pressure or suction on each surface of the glasshouse. Overall pressure co-efficients as applicable to glasshouses are the result of external and internal pressures. The positive co-efficient is that which corresponds to external pressure. The total wind load on a structure is obtained by mathematically taking into account all of the loads on all surfaces.

Pressure co-efficients

When wind of a given speed meets a vertical surface it creates a certain pressure. If the surface is inclined at an angle the pressure will be reduced. The ratio of these two pressures is known as the pressure co-efficient. Suction is represented by negative values.

It is assumed that roof slopes of glasshouses are between 25 and 27 degrees to the horizontal. Variations from this will be of significance.

Wind parallel to the ridge

Roof:		— 0·4 normal to both roof slopes
Gables:	windward	+ 0·7 horizontal
	leeward	— 0·4 horizontal
Sidewalls:		— 0·4 horizontal

Drag + 0·05 horizontal (based on plan area) to be applied at effective height of roof. With currently conventional glazing systems half of this may be assumed to be dissipated through the glass or other rigid sidewall sheeting.

Wind transverse to the ridge

Roof:	windward	— 0·2 normal to roof slope
	leeward	— 0·4 normal to roof slope
Gables:		— 0·4 horizontal
Sidewalls:	windward	+ 0·7 horizontal
	leeward	— 0·4 horizontal

Drag + 0·05 horizontal (based on plan area) applies to multi-bay houses only, to be applied at the effective height of the roof.

Because of the variations due to changes in shape and height a specific example better illustrates the effect of wind load. Thus, a typical single span 30 ft house will have a pressure of 9 lb per sq. ft on the windward wall, a suction of 3 lb per sq. ft on the windward roof slope, and a suction of 5 lb per sq. ft on the leeward roof and wall. Although there is a considerable measure of conformity internationally on three of these, the co-efficient for the windward roof slope varies considerably. This is due to its rapid change as roof pitch alters, the flatter the roof the greater the suction, and vice-versa. The British Code is more specific on roof pitch than any other code.

This Q22 glasshouse was the first to be designed to the new standards

Crop load

This takes two forms; the vertical load on the roof truss and the tension in the crop wires which are fastened to the gable end. Both are taken into account but it is not necessary to withstand the crop load at the same time as the snow load. The code specifies that the glasshouse structure shall be capable of supporting the crop load. The weight of the crop uniformly distributed on plan is 3·13 lb per sq. ft (150 N/m²).

Due regard must be paid to the horizontal forces imposed on the structure by the crop support wires. These should be mild steel and an effective maximum in the steel stress of about 22 tons per sq. in. (350 N/mm²) is assumed. The load in a given wire depends on the distances between roof trusses; thicker wire is needed as this distance increases. The horizontal force on the gable of a 22ft span house can be over 2½ tons. Such a load requires quite substantial structural members to carry it and these will normally take the load either into the ridge and purlins in the roof or into the gutter.

Foundations

Quite apart from the controversy on wind loads, the question of the effective bearing pressure of soil in a glasshouse is not untypical of the divergence between traditional theory and traditional practice.

Designers are rightly conscious of cracks in the walls which are usually caused by variable settlement of brick buildings. Since enlarging foundations represents such a small part of the total cost of a brick building, there is little purpose in objecting to bearing pressures as low as half a ton per square foot. The sustained load on foundations of many existing glasshouses can be in the order of three tons per square foot throughout most of the growing season and at times of heavy snow it can be more than doubled. Despite this, no example can be recalled of foundation failure in glasshouses, apart from on notorious peat soils.

Fortunately, the new Standard Code of Practice on foundations sets out the facts very clearly. A figure of 2·1 tons per sq. ft (225 kilograms per square metre) has been selected for all normal soils.

Glass

Because of the absence of reliable information the British code makes only a brief mention of glass. The latest draft Dutch code goes into much more detail and sets out the allowable size according to the thickness of the glass. The Dutch code has three tables covering the separate cases where glass is supported on two, three or four sides. This approach is completely logical and it will be interesting to see how it works in practice. It could have a profound effect on glasshouse design.

Influence on design

Two questions everybody would like answered are—what effect will the standards for glasshouse loading have on price and how will it change the design? Ultimately the code should make glasshouses slightly cheaper because the snow load has been reduced by about a quarter. However, there are some which were either designed to a lower specification or perhaps have one or two structural members, such as a stanchion, which will have to be strengthened or braced to conform to the re-defined wind loads. In particular a glasshouse must have good controlled ventilation, there must be plenty of headroom under the gutter and ample space for working. It must have good light transmission, freedom from maintenance, and a long life. All these are essential, but only provided that they do not cost too much.

How effectively the manufacturers will be guided by the standards and meet these requirements remains to be seen. In the final analysis the real issue is what action arises out of the theory.

Francis R. Frampton was the Chairman of the drafting sub-committee appointed to consider minimum standards for glasshouse construction.

Cereals on Sand Land

S. P. McClean
Director of Gleadthorpe Experimental Husbandry Farm

THE operations involved in growing cereals are relatively easy on really light land. Ploughing, using wheeled tractors, can take place whenever the weather is reasonably dry during autumn and winter; spring seedbed cultivations and drilling can be accomplished early and quickly; subsequent operations such as top-dressing, spraying and combining can be carried out without danger of rutting.

Unfortunately, cheapness of cultivations is offset by poor average yields and financial returns. This has been particularly apparent in 1970, when farmers on soils containing a high proportion of coarse sand on the eastern side of England have experienced exceptionally low cereal yields. This has been the case at Gleadthorpe E.H.F., where the arable land consists of coarse sandy loams to loamy coarse sands, the latter soils being considerably poorer than the former. Winter wheat has yielded only 25 cwt per acre and winter and spring barleys 17–20 cwt per acre. Yet in 1969 winter wheat gave 37 cwt per acre and spring barley 32. This illustrates the extreme season-to-season variability of cereal yields on sandy land.

Rainfall and drought

The spring of 1969 was late and crop growth was slow until June. However, heavy rainfall in May was followed by the unusual combination of above-average rainfall coupled with above-average sunshine in June and July. In 1970 spring was late again, but was followed by above-average sunshine accompanied by exceptionally low rainfall from mid-May onwards, a total of only 1·79 in. falling between mid-May and the end of July. Clearly, rainfall is the main factor that varied between the one season and the other and produced such extremes in yield.

In most years the weather is less extreme than in 1969 and 1970, varying from wet dull summers, such as 1968, when yields of cereals on all soils are depressed, to drier summers when plenty of sun gives bumper crops on stronger soils but temporary moisture shortages limit yields on coarse sand.

The vulnerability to drought of cereals grown on coarse sand soils is easy to explain. The roots of well-established cereal crops explore the top 14–18 inches of soil. Coarse sands at field capacity can contain as little as 1½ in. of water available to plant roots in this zone. In May the crop will lose by transpiration one inch of water in every ten rainless days, rising to one inch every eight days in June. Thus in these soils fifteen days of drought in May or twelve days in June can exhaust the reserve of available water in the soil.

In the rather better light soils, such as coarse sandy loams, the reserve of available water is greater and droughts need to last at least eighteen days in June before cereal growth is seriously hampered.

Irrigation

It appears that there could be a strong case, where water is available, for irrigating cereals on farms situated on sandy soil. This was studied at Gleadthorpe between 1961 and 1964, when the spring times were wet. It was found that winter wheat given 1½ in. of water at the 'boot' (ear emergence) stage gave an average yield of 39·8 cwt per acre, i.e., 4 cwt more than the unwatered crop. Spring barley given 1½ in. at the late tillering or 'boot' stage yielded 37·8 cwt per acre on average, an increase of 3·4 cwt. Observation studies made during a dry June and July in 1967, following a wet May, confirmed that prevention of moisture shortage during these early stages in crop growth is more crucial to obtaining a good yield than is the presence of adequate moisture during the grain-filling stage. In 1970, when the soil moisture deficit under spring barley reached 2·7 in. on 2nd June, with the crop in the late tillering stage, a comparison was made between no irrigation and the application of 2 in. of water. The yield response was far greater than had been experienced before, the unirrigated and irrigated crops yielding 18·9 and 27·6 cwt per acre respectively. However, it is important to view this very large benefit from irrigation in the context of the majority of years when much smaller responses must be expected.

In the occasional dry year the irrigation of cereals can be regarded as profitable only if the cost of the equipment is being borne by a water-responsive high-value cash crop, such as potatoes. The irrigation of cereals does present other problems as well; for example, the difficulty in covering an adequate acreage before the crops have passed the responsive stage, and the heavy labour requirement at a busy time of the year.

Crop rotations

It has to be accepted that most cereal crops grown on sand land cannot be irrigated because of the kind of problems mentioned above, and also because a major proportion of the farms on such soils in the eastern counties have no access to cheap water. On all soil types, barley growing has become less profitable in recent years. This trend must be most keenly felt by those farmers working unirrigated sand land who have tried to simplify their farming by increasing their acreages of relatively low yielding spring barley. Worse still, on farms where the increased cereal acreage has been achieved by growing barley in long runs, the yields are likely to be depressed still further, as suggested by the results of a trial that has been in progress at Gleadthorpe for seven years.

Sequences of continuous barley following a two-year break of oats and sugar beet were started in each of the six years from 1963–68. This has enabled yields of crops at different stages in a continuous run to be compared under the same conditions each season. Within each crop a range of nitrogen rates have been compared to see whether heavier rates are required by crops several years on in the run, in contrast to those grown during the first year or two following the break.

The overall drop in yield from the first to the fifth crop has been 20 per cent. Ninety units of nitrogen per acre has given optimum yields in all crops

but has not altered the rate of decline. Surprisingly, on average, rates higher than ninety units have not given further yield increases, even with crops well on in the run. The average yield of spring barley grown after a break crop at Gleadthorpe is about 30 cwt per acre, so a 20 per cent reduction from this level gives expected field yields of around 24 cwt in the fourth and fifth crops. This yield would give a gross margin of £19 to £20 per acre, leaving little, if any, profit after deduction of fixed costs. Results obtained in 1968 and 1969 have suggested that yields may recover slightly after the fifth crop, but the 1970 results have not borne this out.

One must conclude that, ideally, rotations should not include more than two consecutive white straw crops between break crops. The first cereal can be winter wheat on all but the poorest sand soils, which will leave a better gross margin than that given by spring barley.

Break Crops

The choice of break crops poses many problems. Over a period of three years beans and oil seed rape were tried at Gleadthorpe and the average gross margins amounted to only £19 and £14 per acre respectively. Other sand land farmers had similar experiences with these crops. An oat crop can act as a break from white straw crops and give an entry for winter wheat, by virtue of its freedom from Take All and Eyespot. However, at Gleadthorpe spring oats have yielded 2 to 4 cwt below spring barley crops grown after a break and are liable to damage by cereal cyst eelworm. Winter oats are far more promising; in 1969 and 1970 plots of Pendrwm yielded 41·3 and 33·8 cwt per acre, equal to plots of winter wheats on the recommended lists grown alongside. They are less sucseptible to eelworm damage than is the case with spring oats but there is a risk that they may increase levels of eelworm in the soil, to the detriment of subsequent cereal crops. Another break crop that has the virtue of using cereal growing equipment is peas grown for harvesting dry. These were grown from 1960 to 1966 at Gleadthorpe and the average gross margin was £40 per acre. The biggest snag was the labour required for tripodding, but this problem may be overcome in future by the development of new varieties that are more suited to combining from the swath, or direct after chemical dessication.

Cash root crops are a traditional break from cereals on sand land. Sugar beet is particularly suitable as it is relatively drought-tolerant and profitable if heavy yields are achieved and spring work mechanized sufficiently to reduce labour costs. Potatoes, particularly Pentland Crown, are grown on unirrigated farms on the Nottinghamshire sand lands but the risk of prolonged drought in the occasional season has to be accepted. Where irrigation is available, sugar beet and potato yields can be guaranteed in dry seasons and these crops are the mainstay of some all-arable farms. Vegetables, including carrots for canning, can serve as break crops between cereals and may become more widely grown on sandy soil, particularly where irrigation is available and if the market for convenience foods, prepacks etc. expands still further.

Use of leys

The introduction of leys into predominantly cereal farming systems appears to be the surest way of improving the performance of cereals on sand soils. An experiment has been running at Gleadthorpe for twenty years comparing the output from several six year rotations, each containing three

common arable test crops: potatoes, winter wheat and spring barley. In one rotation these crops follow a three year ley, while in another they follow sugar beet, oats and one year ley.

When the yields of the test crops in the second cycle of the six year rotations were compared, it was found that the presence or absence of the three year ley had very little effect upon potato yields. However, the longer ley consistently raised the winter wheat yields by 3–4 cwt per acre and spring barley yields by 5–6 cwt per acre. Nitrogen rate comparisons were made on these crops and the results suggest that extra nitrogen could not compensate for the lack of the longer leys in the mainly arable rotation.

Having indicated that the ley is valuable in the cereal cropping context, it would be very satisfying to be able to state that leys are bound to be profitable and problem-free. Unfortunately, although it is now possible to indicate ways of achieving reasonable gross margins with cattle on sand land leys, the heavy capital requirement involved poses a problem in itself.

Rotational farming is important on coarse sand land; firstly to avoid the depressed cereal yields caused by growing long runs of spring barley, and secondly to include enterprises on the farm that are inherently more profitable than cereals. It appears that many sand land farmers will have to depend mainly upon leys and cash roots to provide these breaks, although in some cases growing vegetables for processing may ease the problem.

Capital and Credit in Agriculture

The Agricultural Ministers have appointed Professor J. S. G. Wilson, head of the Department of Economics and Commerce of the University of Hull, to undertake a fact-finding enquiry on behalf of the Government into the capital and credit situation in United Kingdom agriculture, having regard to prospective developments in the industry. The study, which is expected to take about a year to complete, will cover a field of economic policy which has become of increasing significance in recent years with the growth in size and specialization of farms and the replacement of farm labour by capital equipment. Among the subjects to be examined will be:

Total Agricultural Assets: amount; how split between land, buildings, stock, cash and deposits.

Credit: amount; sources, both institutional and private; trends in the pattern of lending and borrowing; changes in needs and in institutional arrangements for agricultural finance.

Investment: return on capital invested in land, fixed equipment and current farming activities; effects on investment decisions; extent to which investment and return may be affected by non-agricultural factors.

In the course of the enquiry, Professor Wilson proposes to collect information from farmers, landowners, and growers and to visit a number of them. He will also hold discussions with the landowning and agricultural organizations, the banks and other financial institutions.

Single sucklers at work

Feeding the Single Suckler

L. R. Gurnett and N. Lawrence, *Trawscoed Experimental Husbandry Farm*

In 1969 the beef herd at Trawscoed consisted of forty-three Hereford cross Friesian cows with calves from South Devon and Hereford bulls. Of these twenty-three calved in the spring; mainly in February, March and April; the other twenty calved in the late summer and autumn in July, August and September. This year the herd is increased to sixty cows by the introduction of heifers. The aim is to produce fat cattle in fifteen months from both groups of cows with feed to come largely from grass and silage. With good quality roughage cows have little need for concentrates except as a carrier of magnesium.

Autumn-calving cows

These were housed in December in a cubicle house with covered self-feed silage available *ad lib*. The calves had a creep area where they could lie down and where concentrates were fed. In the spring (late April) these cows were turned up the hill as soon as grass was adequate. Before 1970 the calves were turned out with their dams until weaning in June; in spring this year they were weaned and the cows, after drying off in the yards, went to the hill without their calves. The average weight of these calves at weaning was 490 lb. They were allocated an area of lowland grazing, which they shared with eighty ewes on a mixed stocking basis, and they should finish during this autumn and winter. In 1969 half of the cattle were sold fat at the end of November; another four were finished at the end of December

and the rest in January and February. Of the twenty cows on this treatment nineteen calved. One cow calved late and was transferred to the spring-calving herd for 1970 at a reasonable valuation. One cow died after calving.

Just before calving started in late July the autumn-calving cows were fed 3 lb per day of a magnesium rich concentrate as they are very susceptible to hypomagnesaemia at this time. The concentrate feeding was continued at this level until the cows were housed in mid-to-late-November. Total concentrate fed per cow was about 3 cwt depending on the time of winter housing. As soon as the cows were housed the concentrate feeding stopped and the cows relied on the silage for all their requirements. During the winter the cows ate 5½ tons of 23 per cent dry matter, 16 per cent crude protein silage. The calves had immediate access to concentrates in a creep area in part of the cow cubicles. A palatable home-mixed cereal ration of barley and molassin meal was fed in the first three weeks but after this an all-cereal ration was used. From November to early February the calves ate 2 lb per day on average. From early February the intake increased to 3 lb per head per day. By mid-April the calves had eaten 3½ cwt of cereals per head.

After weaning in mid-April the cows were turned on to the hill with no supplementary food. The calves, now averaging 490 lb liveweight, grazed lowland pastures. In late August or early September these calves were fed 2 lb cereal mixture per day and this was increased gradually to 9–10 lb per day in late October or early November when they were housed for the final fattening period. The first cattle to finish in November and early December only needed 4 cwt concentrates whilst the last animal sold at the end of February needed 11 cwt. The average requirement of the group was 6 cwt per head.

Spring-calving cows

The spring-calving cows wintered out of doors but had 24 hour access to silage under a Dutch barn from January until turned out to grass; during this period each ate 3 tons of silage. The area in front of the silo was badly poached but the cows had access to a small area of woodland where they could lie. As they approached calving they were removed from this very wet area to calve in better conditions in another field. Most of the cows calved in February, March and April and as soon as there was adequate grass on the hill they were turned out with their calves.

The later calving cows often had too much milk for the calf and to overcome this were kept on a bare field for a period. Of the twenty-three cows on this treatment all calved and all calves except one were reared. One calf died but the cow reared a foster calf. All cows calved within the year.

The calves averaged 450 lb liveweight at the end of October and, due to lack of accommodation, the best twelve were sold at an average weight of 560 lb. Those not sold were yarded in early December and wintered on a low plane of nutrition of silage and cereal mix to gain just over 1 lb liveweight per day through the 130-day winter. They were then turned out to grass in April 1970 averaging 580 lb liveweight with the aim to produce 1¾ lb per day liveweight gain to finish them in the autumn. Most of these will fatten off grass but the smallest may need a supplementary feed of barley whilst at grass in the late autumn.

Whilst on self-feed silage the cows have little or no concentrates. In the 1969/70 winter they were fed 4 lb cereal per day for five weeks in February

and March, but once the cows were in good condition this was stopped. As the cows calved from February onwards they were fed 3 lb per head per day of magnesium fortified cobs. This continued until the first flush of spring grass was over in mid-May and the danger of hypomagnesaemia had passed. At 4 lb cereals per day the winter consumption of the calves was a little over 4¼ cwt per head.

Management considerations

Beef cows calving in the autumn have a much higher silage requirement for overwintering than spring-calving cows, so the conservation area required is, therefore, greater for this system. This may be an important consideration when planning a hill or upland farm with a limited acreage available for conservation.

The cost of housing can be high particularly if a covered silo is considered necessary. However, cheap kennels can be used and silage does not have to be covered. Once the cows are housed some form of slurry handling equipment is needed and the workload is increased.

The main management problem is to overcome hypomagnesaemia by feeding magnesium to the cows. All calves are given a vaccine which overcomes the blackleg prevalent on the farm. Autumn-born calves are treated for husk in the spring; spring-born calves have the same vaccine as yearlings in their second spring.

Farm Buildings Centre Competition
'Design an Economical Pole Barn'

The Farm Buildings Centre, encouraged by the success of its last competition 'Design a Beef Building for the National Agricultural Centre', has decided to run another competition. The Crown Estate Commissioners have again agreed to sponsor the competition as their contribution to the design of more attractive and economical farm buildings.

The competition is intended to highlight the importance of good design in simple buildings and entries will be judged on technical merit, economic viability and appearance. Entries may be of completed buildings or designs and must be received at the Centre by 28th February 1971.

Full details of the competition and entry forms are obtainable from 'Pole Barn Competition', Farm Buildings Centre, National Agricultural Centre, Kenilworth, Warwickshire, CV8 2LG.

Colour and Farm Buildings

A. C. Hardy

THE increasing application of industrial methods to farming in Britain has resulted in considerable changes taking place in the appearance of farm buildings. Traditionally, farm buildings were similar in scale and constructed of the same materials as the farmhouse. This resulted in a group of buildings which were related one to another in colour, texture, form and scale, so that they created a co-ordinated group that related to the landscape in that they were normally built of what can be broadly termed natural building materials, such as stone, brick or timber.

Today this relationship both between buildings and between buildings and the landscape has been lost, in that new farm buildings tend to be physically much larger, constructed of man-made materials and having a shape which is very different from loadbearing wall buildings. The result of this change is that new buildings are usually not related in any way visually to either the existing buildings or the landscape. They contrast in colour, texture, form and scale and, therefore, are considered to be an unwelcome intrusion into the countryside.

It would obviously be unreasonable to ban the use of man-made materials or to insist on a reduction in the scale of such buildings, as their design is related to an agricultural need. It is, therefore, necessary to consider how the design of new buildings can ensure that they do not visually damage the countryside, while at the same time their capital or maintenance costs do not increase to an unacceptable extent.

What the eye sees

To be able to understand this problem it is necessary to have a basic understanding of visual perception. What we see in the countryside around us is due to the reflection of daylight from all the surfaces in the visual field. This reflected light varies in quantity because of the differences in the reflectivity of the surfaces and differs in its wavelength due to the colour of the surfaces. We obtain the greatest amount of information from the visual scene when the contrast in both the reflectivity and colour is high, and the least information when the contrast is at a minimum. Contrast is affected not only by the properties of surfaces, but also by the characteristics of the illumination. Under bright sunshine three dimensional objects have a high light side and a shadow side, whereas under overcast sky conditions with diffuse daylight all the sides of a building will have a similar appearance. The eye has an automatic reaction to the visual scene, in that it will be attracted to the part of it which has either the highest brightness or the greatest colour intensity. A building which is either very light or is of a bright colour will, therefore, attract attention.

Camouflage?

It has generally been considered that the answer to this problem is to camouflage new farm buildings by matching their colour to that of their background. While such an action would obviously reduce the visual impact of new buildings in the countryside, this may not be the most satisfactory solution. Scenes which contain a moderate range of contrast are preferred to those that are visually monotonous. All buildings contrast with the landscape regardless of their colour due to their geometric form which is always revealed under sunlight; they are, therefore, able to contribute to the interest in the visual scene. This suggests that while new buildings should not dominate the landscape they should not be camouflaged either.

Using colour

The main problem is to investigate how the use of colour can control the dominance of a new building in the visual scene and also relate it to other buildings that are of traditional construction. To obtain this information it was necessary to undertake a survey of both the colours of traditional buildings and their related landscape colours in different regions of the country. This survey included the changes in colour due to both the geology and surface soil colours which are revealed to a maximum extent in winter, and the seasonal changes in surface vegetation colours.

An analysis of this survey produced information regarding both the range of reflectivity that occurred as well as the actual range of colours that existed. In general, traditional buildings have roofs that appear darker than their walls; this is not only because the actual roof material is darker but also because roofs are usually made up of small units which cast a shadow pattern, so that although the roof may be a red tile of similar colour to the brick walls, it still appears darker. It is usually considered that the general countryside is green in colour; however, the analysis shows that it is predominantly a yellow-green changing to yellow and yellow-red in autumn. Even conifer trees are blue-green rather than green. As man-made materials are coloured with synthetic pigments, this synthetic green does not relate to the natural countryside colours but usually appears as a mis-match.

Colours for farm buildings

Taking all these factors into consideration it has been possible to select colours for farm building walls and roofs which permit the range of wall lightness to be related to the lightness of natural walling materials, while the darker colours for roofs will maintain the traditional darker roof characteristics although the roofs may have the same texture as the walls. The actual colours chosen have taken into account the countryside background colours, so that the building colours harmonize with them and do not create a mis-match appearance, nor do they create a camouflage effect which may result in visual ambiguity.

The colour range includes a small number of stronger colours for walls which can also be used for tower silos. As the tower silo cannot be obscured, other than by siting in close proximity to tall trees, it will usually be silhouetted against a bright sky. Therefore it should not be very dark in colour, as many of the present colours are, for it would then appear black for most of the time due to the high contrast with the sky. By using lighter colours, the

highlight and shadow will be emphasized so that the cylindrical shape will be revealed. As the geometric form of both farm buildings and tower silos can contribute a useful contrasting feature to the non-geometric landscape, it appears logical that in landscapes which lack a centre of attention there is a case for using stronger colours on some buildings and tower silos.

Design of buildings in the countryside should not be directed to maintaining the existing appearance by camouflage techniques but by the realization that the visual scene can be improved by the contrasting appearance of man-made objects provided that these are related to the scene by means of colour.

Component production

The reason for selecting eight colours for walls, eight for roofs and three accent colours, with the addition of black and white for small scale building features such as doors, window frames etc., is that this allows a manufacturer to select a limited range for mass production; thereby coloured components from a range of manufacturers can be used together without creating colour problems.

The colours selected by the Council of Industrial Design Advisory Panel on Farm Buildings (3rd Report: Colour finishes for factory-made cladding used in farm buildings) have been taken from BS 2660 'Colours for Building and Decorative Paints'. This is the standard colour range used for colouring products for the building industry. Therefore any wall or roof panels produced for the farm building market would also be acceptable to the building industry as a whole. By selecting from these colours probably only two wall and two roof colours, it should be possible for a manufacturer to make such panels at a price which is only 5 per cent higher than that of non-coloured products.

Range of Colours selected by the Council of Industrial Design

Walls	*Value*	*Roofs*	*Value*	*Accent colours*
9–100	(6)	3–036	(6)	0–003
5–060	(6)	4–049	(6)	1–023
4–050	(4)	9–096	(6)	7–085 and black (9–103)
3–044	(4)	9–097	(4)	and white (9–102)
5–058	(8)	9–101	(4)	
3–035	(8)	9–098	(2)	
2–029	(4·5)	4–051	(2)	
1–024	(3)	3–039	(1·5)	

If manufacturers of building components comply with these recommendations, the present objections to new farm buildings should be greatly reduced. Eventually the appearance of the countryside could be enhanced by farm developments without necessarily requiring the employment of expert advice.

The author, **Professor A. C. Hardy,** is with the Building Science Section, School of Architecture, University of Newcastle upon Tyne.

During the winter months a useful profit can be made from the growing of lettuce. In this article the authors discuss

Some Aspects of Winter Lettuce Cultivation

J. B. Rothwell **T. Fenton**

WINTER lettuce in the context of this article are those which are marketed between the middle of December and the third week in March. This crop is usually grown in between two successive cucumber or tomato crops, but more recently there has been a tendency to include it in an all the year round lettuce programme. The profitability of this crop can be marginal, particularly in the North, and every attempt should be made to reduce costs by mechanization, by successional planting to equalize the work load with the passage of time, and by the employment of the minimum quantity of materials and capital commensurate with efficiency.

Soil conditions

The lettuce plant is very reactive to soil conditions. The soil must be free draining, have a good moisture holding capacity and be supplied with lime and nutrients in quantities sufficient to establish the necessary pH value and a desirable salt concentration. Mineral soils with pH values lower than 5·6 are liable to cause damage to the plants due to the excessive uptake of manganese and aluminium which become highly available under acid soil conditions. On the other hand, lettuce will tolerate slightly alkaline soil conditions, although they are best avoided because of the possibility of deficiencies of iron, manganese and boron. A pH value of 6·3 to 6·5 is ideal on mineral soils but 5·7 is suitable when growing in peat. Even in organic soils severe trouble occurs at low pH values if there has been considerable alteration to the structure with materials of mineral origin.

Winter lettuce are usually grown in a rotation with tomatoes, which require a comparatively strong soil solution (conductivity factor of 2,600 micromhos) for the production of quality produce. This condition is not suitable for the most favourable growth of a lettuce crop and a considerable proportion of the mineral salts in the soil have to be removed by flooding before lettuce is planted. The quantity required is usually about 70,000 gallons of water per acre to leach the excess soluble salts from the soil. This more dilute soil solution should have a conductivity factor value in the region of 2,200 micromhos measured by the saturated calcium sulphate method. Lettuce grown in soils containing large quantities of mineral salts become dwarfed and dark green in colour, and are very delayed in forming hearts.

Nutritional experiments have shown that a lettuce crop takes up 200 lb of potash and 100 lb of nitrogen per acre. It has also been found that the residual

fertilizer value from an adequately manured tomato crop is sufficient to supply these quantities of nutrients. If the lettuce follow a different crop which has been at a lower nutritional level, the requirement will be supplied by 400 lb of sulphate of potash and 500 lb of sulphate of ammonia per acre, or the equivalent. Whilst phosphate is usually present in adequate quantities in glasshouse soils, the application of superphosphate may be very advantageous. This is especially so after steam sterilization has given rise to excessive soluble aluminium and manganese or where the pH value is too low. An application of 5 cwt per acre of superphosphate will precipitate the excess quantities of these elements.

Additions of organic matter in the form of peat or farmyard manure improve soil structute and moisture holding capacity and should be given each year. Peat at 4 or 5 tons per acre is preferable where tomatoes are also grown; farmyard manure may cause excessive growth in this crop.

Propagation

There are several propagation techniques which may be successfully employed when raising lettuce seedlings.

1. Planting may be done when the plants are showing their first true leaves straight from the seed tray into the open border.
2. As an alternative they may be pricked off into soil blocks, which can be stood block thick until the plants attain the rosetting stage, usually after 5–6 weeks. This treatment will reduce the time in the growing house border by approximately three weeks.
3. Immediately germination has taken place the seed trays can be placed in a growing room for a period of three days at 21·1°C (70°F) with a continuous illumination level of 500 lumens per square foot; they are then planted straight into the glasshouse border.
4. Seedlings which have been illuminated for three days in the seed tray may be pricked off into soil blocks and given a further seven days illumination. If this treatment is applied, seeds may be sown 5–6 weeks later than naturally raised ones and the plants still be harvested at the same time.
5. Instead of using a growing room, lights may be suspended over the propagation bench. An easily erected lighting unit can consist of seven 8 ft fluorescent tubes evenly spaced 18 in. above a 3 ft wide bench. These specifications will give a light value of 500 lumens per square foot at bench level.

Glasshouse environment

Light, temperature, carbon dioxide content and humidity of the air all have a strong influence on the growth and maturity of the lettuce crop. During most of the growing period we have no control over light, and temperatures have to be adjusted to suit the low levels of solar radiation experienced during this period. A lettuce plant which is grown at high temperatures in low light conditions tends to have long narrow leaves and to be delayed in forming a heart, giving rise to produce of poor market quality. A night temperature of 7·2°C (45°F) for Dutch and 10°C (50°F) for English varieties is quite adequate. As with other crop plants it is desirable to have a

higher day than night temperature. During the daytime the temperature should be increased by 5·6°C (10°F) by pipe heat to give 12·8°C (55°F) for the Dutch and 15·6°C (60°F) for the English varieties. During periods of sunshine the temperature should be allowed to rise naturally to a limit of 21·1°C (70°F) from the time of planting to when the leaves of adjacent plants touch each other. This higher day temperature in sunlight will accelerate the rate at which the crop covers the ground and result in earlier maturity. When adjacent plants are touching each other, the natural temperature should be limited to 15·6°C (60°F) to help the plants in the formation of hearts.

Carbon dioxide enrichment in periods of sunshine hastens maturity, improves hearting and gives the plants a greater resistance to Botrytis infection and marginal leaf scorch. This may be applied by supplying 40 lb per acre per hour of pure carbon dioxide from cylinders or by vaporizing dry ice. Alternatively 13 lb per acre of propane will supply 40 lb of carbon dioxide per acre when burnt in special burners.

Irrigation

The amount of water lost by crops during the period November to February is very small. For example, transpiration in the whole of November is usually no more than that which takes place on a bright cloudless day in June. The requirements of a winter lettuce crop are nearly satisfied by the pre-planting flooding of the soil which brings it to field capacity level. Watering should be very infrequent, with small quantities applied. However, an application a week before the expected cutting date is advantageous.

Little is known about the influence of humidity on the growth of lettuce, but excessive ventilation combined with lack of spraying overhead on mornings of sunshine causes retardation of growth due to wilting, and a greater susceptibility to Botrytis. However, overhead spraying or watering should be done early in the day to avoid excessive water on the leaves.

Generally one must not expect generous profits from winter lettuce. The growing of this crop does, however, provide employment during the difficult winter period, enabling regular staff to be retained full time.

Varieties

The more recent introductions of winter forcing lettuce are taking over in popularity from the Cheshunt 5B and Early Giant. Valentine and Neptune, bred and introduced by the Glasshouse Crops Research Institute, are two such varieties which are very widely grown and develop rapidly, being 7–10 days earlier than other varieties. They give a good hearted lettuce, making an attractive pack.

Many other varieties are grown today, taking 15–20 weeks to harvest from sowing according to the prevailing light conditions. Kwiek is a very popular variety, producing good heads of medium green, making an attractive pack. Korrekt, Knap, Noran and Amanda are all good varieties and are similar in many respects to Kwiek. Kordaat is extremely reliable, producing a very attractive lettuce with a flat base, but takes some 7–8 days longer to mature. Seagreen and Emerald are two new varieties from the G.C.R.I. and are for cool grown crops. Cold crops of these have been cut in February and March at 5 oz in the South.

The authors are **J. B. Rothwell, B.Sc.(Hort).** a horticultural officer, and **T. Fenton,** a scientific assistant, stationed at Fairfield E.H.S.

The author, A. K. GILES, B.Sc., Econ., of the Department of Agricultural Economics, University of Reading, discusses the role of

Management Consultants

NOT many years ago the main problem confronting any farmer who needed the services of a management consultant would have been where to find one. In a relatively short space of time his problem has changed to one of deciding which one to choose. During this period the contribution that the science of management can add to the already well practised arts of management has, at last, been generally recognized in agriculture. The pioneering work begun by agricultural economists in the early 1950s and continued by the N.A.A.S. during the middle fifties and sixties has led to a climate of understanding in the farming community which, coupled with economic pressures, has enabled the management consultant to emerge. He is a new element amongst agriculture's ancillaries, still growing both in numbers and in the diversity of services that he can offer—and by no means uniform in type.

Types of consultants

The consultant may, for instance, be part of a large commercial organization for whom a management consultancy service is simply part and parcel of an already elaborate sales service. Such services have had their forerunners for many years before their recent mushrooming. Alternatively, he may belong to a smaller professional firm that has previously operated mainly within a particular professional discipline (e.g., land agency or accountancy); but now it offers management consultancy either as a natural development of its original work or because of a need or desire to expand and diversify its activities. In much the same way, producer organizations, conscious of the difficulty of isolating a particular farm enterprise with which they may be especially concerned from the total farm management problem, have also entered the field. Finally there are the independent, fee charging, specialized management consultants; these vary from the very few large scale, well established, organizations operating on a national basis and offering a wide range of services—and themselves calling in specialists if they do not have the know-how required—to much smaller farming companies or groups of farmers operating in a more local and restricted field. At the extreme end of this scale one should not overlook the individual farmer who sometimes acts as a consultant to his neighbours—with an emphasis on technical advice based on his own experience and ability. Interestingly, the Australasian system of farm management clubs, by which groups of farmers jointly retain a private adviser, has not developed in this country.

The wide choice now open to a client has, however, been known to create its own confusion—resulting sometimes in advice being sought from several different sources at the same time. If, then, conflicting advice is received, the confusion can be increased to the extent that nothing is done at all. The situation can be further complicated by the fact that, at this relatively early stage in the development of farm management consultancy services, there is no guarantee of the competence of *all* consultants in *all* of the fields in which they profess to operate. This is largely a matter of consultants themselves learning their own trade by experience, which some have done and others, naturally, have yet to do.

In these situations there is no doubt that farmers do and will continue to rely heavily on their local agricultural advisers, backed as they are by the full depth of an established and proven technical and management advisory service. Why 'buy', it might be asked, what can be had free? One immediate answer to this question lies in the different objectives that must confront any government sponsored service as opposed to a commercial one. Obligated as they are to provide advice to any farmer who asks for it, government sponsored advisers must in the last resort, be limited in how much time they can give to each client. By contrast, the one commodity that a farmer can buy with certainty from a private consultant is his 'time'. It is perhaps in this respect that the private management consultant can offer a product that is most likely to be altogether different from that of the more traditional advisory services. The amount of time that a farmer feels he needs to buy—and what rate he has to pay for it—will clearly be important factors in his choice. So also should be the type of advice he is seeking, and the reputation of those from whom he seeks it.

Why seek advice?

There are various reasons why it may be sensible for a farmer to seek advice. Amongst the most important are the need for:

Guidance or instruction on some technical aspect of farming (including the use of machinery and buildings). This could be particularly necessary where a new enterprise or type of resource is being contemplated; and the inseparability of the technical and the strictly managerial aspects of farming bring this type of advice firmly into the consultants orbit.

Advice of a strictly economic nature, whether it concerns some part of, or the whole of, a farm business; the analysis of past performance, or future planning, trading operations or questions of capital procurement and investment. In practice most of these things will sooner or later become part and parcel of the whole process of advice of this type.

An outsider with a 'trained eye' to give his opinion, either to confirm the views of the farmer or to help overcome the fact that the farmer may be too close to his own business to view it objectively.

Specialized guidance in one of the more complicated aspects of business management, e.g., taxation; recruitment of staff.

A feasibility study of a new project, to meet either statutory or other requirements.

Assistance in the control of operations over a period of time, as opposed to 'on the spot' advice, with guidance in costing and control technique appropriate to the task.

In addition, the private consultant may sometimes be employed for more personal and less justifiable reasons where, for instance, the word 'private' implies (wrongly) that conventional sources of advice may be less confidential; or where the word 'consultant' has, for the client, a prestige value for which he is prepared to pay. Few private consultants, however, would feel secure if their businesses relied heavily on clients motivated in either of these ways. Instead, they know their stock-in-trade, whatever their speciality, must be the ability to give a client whatever time and genuine expertise he needs and can buy.

The real value of advice

From the client's point of view the value of a consultant frequently begins, not ends, at the point at which advice is actually received. It is then that advice can be accepted or rejected either in total or in part. It is at this point, frequently, that the longer term value of contact with fresh thinking, with new professional contacts and with appropriate follow-up advice can be more important than the bare advice given in response to the initial request for it. Indeed, most experienced advisers and consultants will not expect, nor necessarily want, the broad sweep of their initial advice to be accepted lock, stock and barrel. Where, particularly, the whole question of farm policy becomes the subject of advice—as sooner or later it invariably does, however narrowly the first problems are posed—a gradual acceptance of the directions in which the advice is pointing can be a sounder basis for progress. Similarly, a successful personal relationship between client and consultant is usually one that grows over a period of time, based on mutual respect and an understanding of each other's attitude and field of competence. There is a natural disinclination on the part of most people to seek and take advice and this is often reflected in the 'reserve' at early meetings between the adviser and the advised. In the case of management advice, which in a farmer's case concerns his very ability to farm, there are, in addition, special problems of psychology and communication. These problems have been discussed elsewhere by the present writer*. The experienced consultant will be alert to them and will know that his own gradual approach to his client, coupled with his own proven competence, will be the most sure guarantee of his future employment.

The future

In these circumstances, the belief that all advisers are in the process of working themselves out of a job need not unduly concern them. In a recent survey conducted by Reading University nearly a third of a large sample of salaried farm managers confessed to feeling 'least well equipped' to manage their business in the general field of 'finance and business matters'. Salaried managers represent a small proportion of the total who manage the nation's farms, and of the particular sample in question some 90 per cent possessed either agricultural diplomas or degrees and might be expected to be better equipped than the average farmer. There is, therefore, no reason to suspect that there is likely to be a shortage of persons who in the immediate years ahead will be seeking advice. Frequently, but not always, it will be of a

*On getting Farm Management Advice Across to the Farmer. A. K. Giles and G. D. Salmon. *N.A.A.S. Quarterly Review*, No. 85. Autumn 1969 available from H.M.S.O. (Addresses on p. 538), price 3*s*. (by post 3*s*. 4*d*.).

management type, and again there seems no reason why the differing services offered by the traditional adviser and the consultant should not continue to complement each other as they have done until now.

The work of the consultant is to help farmers and farm managers to make their own decisions, rather than to make the decisions for them, thereby leading to a wiser use of their resources. To this extent, consultants must never be surprised to find that they themselves will be, and should be, regarded simply as one of those resources; one that will be used increasingly with discrimination.

The Ministry's Publications

Since the list published in the October, 1970 issue of *Agriculture* (p. 485) the following publications have been issued.

MAJOR PUBLICATION

BULLETIN

No. 153. Sugar Beet Cultivation (Revised) 15*s.* 6*d.* (by post 16*s.* 2*d.*)
(SBN 11 240453 7)

FREE ISSUES

ADVISORY LEAFLETS

No. 106. Apple Aphids (Revised)
No. 392. Lettuce Aphids (Revised)
No. 414. Elworms on Strawberries (Revised)
No. 480. Cannibalism and Feather Pecking in Poultry (Revised)
No. 536. Tulip Fire (Revised)

SHORT TERM LEAFLETS

No. 60. Field Beans (Revised)
No. 80. High Nitrogen (Revised)
No. 103. Mechanized Handling and Feeding of Bunker Silage (New)
No. 106. Minimum Standards for Glasshouse Construction-loading (New)
No. 108. The Drying of Grass Seed (New)

POSTER

Fireblight on Hawthorn, Cotoneaster and Whitebeam (New)

Priced publications are obtainable from Government Bookshops (addresses on p. 538) or through any bookseller. Single copies of the free items are obtainable from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex, HA5 2DT.

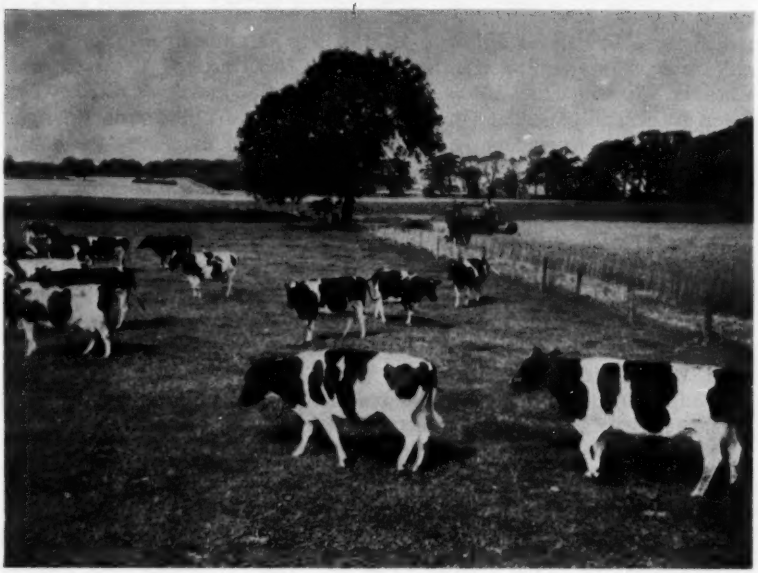
White Rust of Chrysanthemums — A Warning

Commercial growers in all areas are advised to watch for signs of White Rust on their chrysanthemums, especially when plants are being brought into glasshouses for the winter. Caused by the fungus *Puccinia Lhoriana*, the disease can be a serious threat to chrysanthemum production.

Any suspicious symptoms should be reported at once to any local office of the Ministry of Agriculture, Fisheries and Food. Symptoms of White Rust are yellow spots on the upper surfaces of leaves, the centres of these spots later turning brown. On the lower leaf surface slight protuberances develop under the spots. The protuberances are at first buff or pink but eventually become white. They are then up to one-eighth of an inch or so in diameter and quite prominent. Microscopic spores released from infected leaves will infect other leaves.

The disease has occurred for many years in China and Japan but was first found in England in 1963 in Essex.

Advice on protective measures may be obtained from the National Agricultural Advisory Service.



British Friesians in a Staffordshire scene

40. Staffordshire

P. W. Milligan

'STAFFORDSHIRE', lying in the heart of the industrial West Midlands, inevitably conjures up a picture of smoking factory chimneys and networks of roads and rail communications, interspersed with but a small area of agricultural land. How far this is from fact is best revealed by a visit to what is undoubtedly a very progressive and beautiful county.

Industry

It is true that Staffordshire has two main industrial areas—the Potteries to the north and the hinterland of the Black Country to the south. These two conurbations contain the bulk of the population and industry, though other small industrial pockets exist. Somehow the agriculture of the county has been able to contain these areas, and the serenity of the countryside remains undisturbed. The passage from town to country is abrupt, and there is inevitably the consciousness of the great depth of the countryside as the last house of suburbia is left behind.

The Land and its use

The county covers just over half a million acres and contains a great variety of farming enterprises. To the north the wild moorland of the Pennine range

provides keep for hill sheep and cattle and forms part of the Peak National Park. The advent of tourism has brought opportunity and income to the area, but it has also tended to make shepherding less attractive, resulting in a reduction in the number of hill flocks. The high hills quickly give way to the dales and valleys cutting into the limestone rocks around Uttoxeter and Cheadle. This valley area is used for milk production and stock rearing. The farms are generally small and many are worked on a part-time basis, although there is a growing tendency to amalgamate by land purchase—the house continuing to be occupied by an escapee from the industry of the Potteries.

To the south and west of this area the land becomes keuper marl to varying depths and textures, and here the great wealth of dairying in the county, is carried out.

Some 96 million gallons of milk are now produced annually from a total of 112,000 cows spread over some 3,500 dairy farms. The herd size is slightly higher than the national average and, while the county has fewer cows than its neighbour Cheshire (renowned for its dairying), there are as many dairy farms in Staffordshire as there are in that county. Intensive grassland production is practised here, and the impact of silage making and paddock grazing have left their mark. Practically every holding has some form of silage container and a pattern of small paddocks being intensively grazed.

To the south of the dairying belt the county is split in two by the vast area of Cannock Chase; this 17,000 acres of land is designated an area of outstanding natural beauty and provides a pleasant escape to Midlanders from the concrete jungles of the Black Country cities. The Forestry Commission have planted a considerable area of woodland and the similarity to the Black Forest area of South Germany has not gone unnoticed; a cemetery even provides the resting place for German dead of the last two world wars. The scrub and birch land adjacent to the planted areas are home to wild fallow deer, whose ancestors were hunted by royalty and bishops in the area. The deer and other fauna and flora make the area a naturalist's paradise.

South and to the west and east of Cannock Chase the land becomes lighter and, whilst some dairying is still practised, arable production predominates. Potatoes, sugar beet and cereals are the main crops but vegetable production and the production of more exotic crops play a part in the economy. Asparagus, blackcurrants, strawberries, ornamental trees and shrubs, flowers and pot plants for the urban neighbours reveal that the Staffordshire farmer and horticulturist are men of acute business acumen, quick to appreciate that the industrial areas can provide a market for those things which he can produce to advantage.

The county grows some 11,000 acres of potatoes and 3,500 acres of sugar beet, mostly in this southern area. They form a useful break crop and are very fully mechanized as they must be with strong competition from industry for the available labour. Immigrant labour for casual work on farms is almost unique to this part of the country, and it is indeed a fantastic sight to see literally hundreds of Pakistani and Indian workers picking fruit. Their chatter and the gay colours of their clothing could well make any visitor to this part think that he had arrived in an Indian tea garden!

Throughout the county the quality of the livestock is second to none. The dairy herd now is predominantly Friesian, though some renowned herds of Ayrshire and Channel Island breed are evident. The sale of young stock for beef production in other parts of the country is a useful source of income to the Staffordshire farmer, and it is noticeable that most animals at grass are

either productive dairy cows or fattening cattle, with replacement stock kept to a minimum. The pig population of some 102,000, which includes a breeding herd of 12,000, is intensively organized. Mostly now of Landrace or Large White, the herds contain strains of world-wide demand and their export, both nationally and internationally, is a major source of income to the agriculture of the country.

A county of contrasts

Staffordshire can be summed up as a county of contrasts, diversity of enterprises, great interest and beauty; a country keeping its industry within bounds and one very proud of its agriculture.

FOWL PEST

The replacement, in April 1963, of the compulsory slaughter policy for all forms of fowl pest in England and Wales by one of voluntary vaccination utilizing inactivated vaccine, with compulsory slaughter and payment of compensation only for per-acute fowl pest and fowl plague, led to a sharp reduction in the incidence and severity of the disease. A peak of 92 per cent protection of the national poultry population was reached in the second quarter of 1965 and, in consequence, outbreaks of the disease fell from 2,248 in 1963 to only 36 in 1969.

This dramatic improvement was due largely to the excellent response of poultry keepers, many of whom had adopted the policy of vaccinating their flocks regularly as a matter of routine. But the success of the vaccination policy apparently produced a sense of complacency, and from mid-1968 there were indications that the level of vaccination was falling in spite of continual warnings locally and nationally of the possible consequences.

Early in 1969 a small series of outbreaks in Kent demonstrated the severe losses that could follow a failure to vaccinate. On premises where birds were fully vaccinated the disease had very little effect and recovery was rapid. In the non-protected birds the condition was very severe, mortality was high and recovery protracted.

Unfortunately the warning was not heeded, and in late-August this year the disease appeared in Essex in a district with a heavy poultry population. Spread of infection is rapid and wind-borne and the economic losses to poultry keepers who had not carried out a programme of vaccination will be heavy.

Poultry keepers in East Anglia have already been advised to vaccinate or re-vaccinate all their poultry stock, and those in the rest of the country were at the same time advised to resume complete programmes of vaccination as soon as they could.

The warning then is clear—to protect yourself and the industry against the sudden and expensive losses that can occur when fowl pest strikes—**YOU MUST VACCINATE!**

in brief

- **Ergonomics and farm work**
- **Egg image**
- **Lime is not a luxury**

Ergonomics and farm work

A DWINDLING and more expensive labour force, increased capital investment and more costly overheads are the predominant features of modern agriculture, and they are more likely to intensify than diminish. From this it follows that a maximum return must be secured from them if their weight is to be supported by the end product, whatever it is. Unused, wasted or misdirected energy, whether of men or machines, not only reduces operational efficiency, but has its sequels in terms of human attitudes and responses which can only work to the disadvantage of the farming industry. Hence the importance of the still youthful study of ergonomics, which is steadily making its voice heard and increasingly establishing itself in the research programmes of universities and colleges and in the framing of official recommendations and regulations.

Ergonomics is fundamentally a two-point probe into (a) the health and accident hazard to workers, and (b) the operational efficiency of man and machine. New methods and the extensions of sophisticated mechanization almost invariably produce new environments which require to be studied for the effects they may have. Thus noise and vibration levels of field and barn machinery, the posture of workers engaged on specific jobs requiring repetitive manual tasks, exposure to dust and exhaust fumes, uncomfortable ambient temperatures and poor lighting suggest a wide area of potential inquiry and subsequent correction. Two booklets from the University of Newcastle upon Tyne, *The Role of Ergonomics in the Efficient Utilization of Agricultural Labour*, by J. Matthews, and *Human Factors in Agriculture: The Application of Occupational Medicine and Ergonomics*, by J. D. G. Troup*, outline the scope from the engineering and medical points of view respectively and signpost the roads along which ergonomic study and the application of its findings may lead to working conditions attuned to maximum efficiency.

The case for ergonomics doesn't need to be argued; it is self-evident. At today's wage rates and high capital injection, fatigue and sick absence are too expensive to be brushed aside as casual inconvenience. Machine and equipment manufacturers have an important part to play in considerate design. It is not enough that the machine should do the job; the human angle of its operation, comfort and convenience must be studied equally carefully. Computer-controlled and automatic equipment may be expected to take over more and more of the less pleasant chores incidental to daily farm life, with closed-circuit television avoiding the need for frequent close inspection of housed livestock. Although, as yet, the ergonomics probe has not penetrated deeply, it has unquestionably an important future.

Egg image

IN spite of advertising and other promotions it is disappointing to see that the domestic image of the egg remains much as it was five years ago. According to the latest survey organized by the British Egg Marketing Board (covering the three

*Both booklets available from the University. Price 3*s.* 6*d.* each (including postage).

months October-December 1969) the average weekly purchase of 3·8 eggs per person remains the same as it was in December 1965, although the proportion of households not buying eggs at all has fallen from 6·4 per cent to 5 per cent. Without these indications one would hardly suppose that such a highly nourishing and cheap item of food, considered either as a dish in its own right or as a cooking ingredient, could be so low in purchasing preference. It is a matter of even greater surprise that although the buying of eggs increased with the size of family, it did not go up proportionately. On the contrary, it furnishes an apposite example of Mark Twain's 'higher the fewer', inasmuch as families of five or more were buying only 3·3 eggs per person per week against 4·8 for a single person.

Social distinction seems to have some bearing on this, since the 'upper middle class, professional and senior executive' group rated 4·3, as compared with all others at around 3·7. An interesting point that emerged from the survey was the fact that the older housewife tended to buy more eggs per person, and the housewife in the 35–49 age range was the least likely to be a non-buyer of eggs—which puts a question mark against the food preferences of the young married and their families. By region, Scotland's 4·2 eggs per person per week, no doubt reflecting the custom of more substantial teas north of the Border, was higher than elsewhere; the West Midlands and the North West, at the other end of the scale, contenting themselves with 3·5.

Overall, total purchases of eggs per person has changed very little, but it is noteworthy that the proportion of eggs bought at the farm gate and from farm roundsmen continued to rise—which could, apart from households in purely rural areas, show one effect of the increasing penetration of town into country.

Lime is not a luxury

THE importance of adequate lime in the soil has been recognized since very ancient times, and the fact that we are encashing our calcium reserves more speedily today by reason of the increased use of certain nitrogenous fertilizers demands that the lime status of the soil should be examined regularly and appropriately corrected. Without lime, soils steadily become acid; and loss is going on all the time, mainly leached by rainwater but also carried off by crops and pastured animals. Some crops, such as oats and potatoes, are fairly tolerant of acid conditions, but others, like barley and sugar beet, are extremely sensitive. On grassland, the finer species succumb and the sward falls down to the coarser sorts, like bent and Yorkshire fog.

Laboratory testing of soil should be carried out to assess the degree of lime requirement, since overliming can set up trouble from trace element deficiencies. Where lime is found to be needed—and thousands of acres are in this condition—remember it is not a luxury but an absolute essential. And there is a Government subsidy payable on two tons and over if bought from an approved source.

AGRIC

'At the Farmer's Service' 1970/71

A wealth of information of interest to farmers in England and Wales is contained in the latest edition of 'At the Farmer's Service'.

This handy, pocket-sized booklet, issued by the Ministry of Agriculture, Fisheries and Food, describes the many services and facilities provided by the Ministry and gives details of the grants and subsidies which are available to farmers and growers. It also contains the addresses of the local offices of the Ministry and of other agricultural organizations.

Copies can be obtained free of charge from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex HA5 2DT, or from any of the Ministry's Divisional Offices.

Mechanical Cleaning of Cowsheds

J. N. Addison, *Farm Buildings Advisory Officer, Agricultural Land Service, Leeds*

THE practice of using mechanical channel cleaners in cowsheds has been in operation for many years. A survey was recently undertaken in the Yorkshire and Lancashire region to establish the extent to which these cleaners had been installed, their age, condition and the reasons for their introduction in the first place.

Types of cleaner

During the survey two principal types of cleaner were seen. First, the shuttle type in which a metal rod or wire rope with blades or arms attached is moved backwards and forwards along the bottom of the channel. As the arm moves in one direction the blades open out and scrape the channel but as it moves backwards the blades close; this reciprocating action cleans the channels. Second, the continuous type in which a metal link chain in the bottom of the channel moves in a circuit around the shed to the elevator, or other point of disposal, and back again into the shed. Blades are fixed permanently to the chain and are moved round the circuit by the chain so cleaning the channel. The blades themselves are cleaned as they pass over the elevator before being returned to the cowshed. Both types are motor driven. Cleaning time varies from five to ten minutes and the operation is generally carried out twice daily. It is believed that approximately twenty-six cleaners are installed throughout the region, of which half are the continuous type and the rest the shuttle type.

Problems

Twenty one cowsheds were surveyed on eighteen different farms. The number of standings in individual sheds ranged from 26 to 114 but nine installations were in the 40–60 range. Geographically they were spread throughout the region from the Yorkshire Wolds to North Lancashire. Three-quarters of the cleaners were in double-range sheds.

It was claimed that stock soon became accustomed to the moving cleaners. No examples were found where the practice of tying up tails was carried out and no one had made any arrangements to force the cows to stand up immediately the cleaner started to move. A number of the farmers were pedigree breeders and all liked to view their stock; in some instances the bed of the standing was higher than the centre or backwalk of the shed. It was observed that some channels were too shallow, causing the contents to

overflow on to the centre or backwalk, and in one instance the channel was too narrow. Because of this, on one farm it was the practice to walk beside the cleaner with a brush sweeping back the slurry into the channel.

Another problem which arose on some farms was due to the fact that the channels themselves drained in the general direction of the movement of the cleaner causing ponding of liquids, particularly at the door and also at the base of the elevator. The majority of farmers, however, were satisfied with this system of cleaning and in only three instances had it been abandoned. In one case this was because a shuttle type cleaner, used in a double-range cowshed discharged the contents of the channels to a pit from which slurry was pumped. Straw used as the bedding found its way into the slurry, stopping the pump emptying the pit; clearing the blockages meant high maintenance costs.

Keeping cows in sheds is extremely popular with many farmers and no doubt this method of housing stock will continue for many years to come. The survey showed that 80 per cent of the cleaners in use were in existing sheds, although in two cases the system had been adopted in new buildings housing sixty and eighty cows. Nevertheless, it does appear that in most cases the cleaners are being put into existing premises.

Specifications

The most important points to be borne in mind in installing mechanical cleaners are the width, shape and depth of the channel and the length of the standing. Most manufacturers give a very clear indication of the depth of the channel required, and this should be closely followed. In no case should it be less than 8 in. Similarly, manufacturer's instructions regarding the width of channels and the cross fall required should be followed if the standings and backwalk are not to become fouled either directly from the animal or through the channel overflowing when cleaning is in progress. In no case should the width of the channel be less than 18 in. As animals vary in length within breeds it might be desirable to measure all cows in the herd and then construct standings of a length to suit the majority. Three-point quick-release ties will give individual adjustment. In double-range sheds, consideration might be given to the provision of standings of one length on one side of the shed and of a different length on the opposite side. Similarly, it is important that the channel is drained quickly and adequately, preferably in the opposite direction to the movement of the cleaner. If this is not possible—and it will not always be so in the case of a continuous cleaner—then it should flow in the direction of the first entry of the cleaner into the cowshed and not in the direction of the base of the elevator. Ponding of the liquid will otherwise take place at this point, with the consequent freezing-up of the elevator in winter time.

The depth of the channel seems to present no difficulty to the cows when entering their standing. However, for channels sited at entries or exits to sheds where many cows will be crossing, it would be preferable for them to be fitted with removable covers. Areas where channels have to negotiate corners are more liable to fouling and should be kept clear of cow standings. This may require the positioning of the channel corners in a passage at the end of the standing or even outside the building, but the overall effect will be beneficial. Although most farmers appeared to experience little difficulty with breakdowns, regular maintenance is nevertheless well worth

while; particular attention should be paid to maintaining linkage, wires and corner wheels. Mechanical cleaners were found to work perfectly satisfactorily in a dry cowshed.

Cost

Finally, the survey suggested that the cost per cow of the shuttle type cleaner at the present time would be about £21 and that of the continuous type £18.

Atlas of the Cereal-Growing Areas in Europe. Editor in Chief S. BROEKHUIZEN. Elsevier Publishing Company Ltd., 1969. £17 15*s*. [£17·75].

Closer economic collaboration between various European states encourages freer exchange of crop varieties. A guide on soil, climate and crop production techniques pertaining to individual areas within each European country is therefore of interest and value to plant breeders and distributors of seed. This atlas, based on evidence collated in the mid-1960's by the Netherlands Grain Centre, presents a detailed coverage of cereal growing in Europe. With over sixty maps, supported by a lucid concise text in three languages, it sets out to define the likely ecological behaviour of each cereal species and the geographic distribution of varieties within European cereal areas as far as the Urals. The rough grouping of a number of soil associations is based on the International Soil Map of Europe. This limits detailed study within countries but allows for more realistic comparisons of soil suitability for cereal production inter-country.

It is a common observation that many cereal varieties behave as if they have a memory of the environmental factors of their place of origin. A series of maps locate all the cereal breeding stations concerned with individual species, including maize, millet and rice. Other maps indicate the significance of cereals in relation to farm size, cropping systems and the yield levels recorded in each region within each country. Phenological data, alongside climate diagrams, provides a useful basis for the selection of suitable varieties for each region. Recent rapid changes in the structure of farming and crop production emphasis will already have rendered some of the information obsolete, but this atlas is nevertheless a solid foundation for any future detailed study of cereal growing in Europe.

R.G.H.

Since Silent Spring. FRANK GRAHAM, Jr. Hamish Hamilton, 1970. £2.

In 1962 Rachel Carson published *Silent Spring* drawing public attention to the grave risks involved in the indiscriminate use of modern pesticides. To appeal to the lay reader she had to simplify the facts, make general statements and refrain from applying precise statistical analysis. To some scientists she committed the unforgiveable sin of popularising; she trod on the toes of vested interests and some governments caught sitting on the fence between the big money of industry, the apathy of the public and a vague belief that all that is good for food production must be good for the common man. But the public appreciated that the issues raised by Rachel Carson mattered and her book became a best seller.

Frank Graham in *Since Silent Spring* tells us about Rachel Carson and her mission. He shows how in eight years her thesis has been vindicated; while the trees in her forest had faults the forest itself remains standing. He tells how American industry attempted to discredit Miss Carson, how certain governments were reluctant to accept that risks to man himself were involved in the contamination of food chains with persistent insecticides. This example of the intricate relationships

existing in human affairs set against the fact of man's ultimate dependence on his environment makes fascinating reading. But Mr. Graham also reviews the present position and is able to look to the future with optimism, not because of indiscriminate bans on some chemicals but because reason and a scientific approach are prevailing. Much of the new attitude, particularly in the U.S.A., can be attributed to Rachel Carson. Mr. Graham's book is also popular in style, but this is no criticism. It is mostly accurate, but inevitably there are points of detail where the author draws conclusions not justified by the facts. This does not matter and the book should be read by all concerned to appreciate the ways in which vested interests, human greed, lack of knowledge, the manipulation of pseudo-science can become confused in a way that potentially leaves the welfare of man at stake.

In Britain, we have been fortunate to learn from the mistakes made in America, sound Government policies were early formulated, good liaisons with industry have been established and all new agricultural and medical pesticides are properly examined under the Pesticide Safety Precaution Scheme. Our record is good as Mr. Graham shows, but there is no room for complacency.

The greatest hope for man's future is education and this book educates us. Because we are all a bit selfish and do not want to be bored with facts if there is nothing in it for ourselves, let me emphasize that the book makes enjoyable reading. True, it mostly deals with the scandals of the pesticide situation in the United States, but the fundamental message remains pertinent.

R.K.M.

Soils of North Cardiganshire. (Soil Survey of England and Wales). C. C. RUDEFORTH. 1969. £2.

In an age when demands for land come from a variety of sources, the need to have as much precise basic knowledge about this vital but dwindling national asset is self evident. Therefore this survey of 320 sq. miles of North Cardiganshire, plus small sections of Merioneth and Montgomery, is to be welcomed.

This is an attractively printed and well produced memoir. The opening chapter provides a brief but adequate general description of the area, covering geology, climate, vegetation, forestry and the prevailing agricultural patterns of production. Then in much greater technical detail are chapters on the coastal sands, the alluvial flats and terraces, the lowland and upland slopes and finally the mountain slopes. The idea of providing case studies under profile numbers of each soil series is a good one. In all, thirty-eight sites are reported upon in detail.

One is left with the feeling that a thorough job has been done, although it requires an expert in this field to evaluate the considerable factual data. One's thoughts must inevitably turn to wondering how soil detail of this sort can be used by farmers. The few farms that have been soil plotted have a range of soil types on them. Taking this a stage further, the ultimate in precision farming must be to crop or stock each type according to its characteristics.

Mr. Colin Rudeforth is to be congratulated on producing an impressive piece of work.

Copies may be obtained from the Librarian, Rothamsted Experimental Station, Harpenden, Herts.

H.E.

books received

Types of Farming in Yorkshire. Department of Agricultural Economics, University of Leeds, 1970. 3*s*.

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